

# *Oroville Facilities Relicensing Project*

## *California Department of Water Resources*



### **Study Plan SPW-3**

#### *Recreational Facilities and Operations Effects on Water Quality*

*Presented by*  
*Thomas L. Boullion*  
*August 25, 2004*

# ***Oroville Facilities Relicensing Project***

## ***California Department of Water Resources***



### ***Study Plan SPW-3***

#### ***Recreational Facilities and Operations Effects on Water Quality***

***Study Objective:*** The objective of this study is to determine the effects of Project-related recreational facilities and activities on the water quality of those areas adjacent to and under the influence of Project waters. This study will provide information to be used to identify potential protection, mitigation, and enhancement measures.

***Implementation:*** SPW-3 Task 1A identified the types of recreational facilities in the project area and potential impacts to water quality from these recreational facilities (Interim Report, October 10, 2002).

SPW-3 Task 1B determined and implemented monitoring of specific recreational facilities and activities with the potential to introduce contaminants into project waters. Sampling commenced at selected sites in June 2003.

# ***Oroville Facilities Relicensing Project***

## ***California Department of Water Resources***



### **Study Plan SPW-3**

#### ***Recreational Facilities and Operations Effects on Water Quality***

##### ***Six water quality sampling components***

- **Recreational Facilities WQ Sampling**
- **Swim Areas Bacteria Sampling**
- **Fishing Tournament Sampling**
- **Bidwell Marina Special Sampling**
- **Lime Saddle Boat Yard Sand Analyses**
- **Storm Event Sampling 2003**

# ***Oroville Facilities Relicensing Project***

## ***California Department of Water Resources***



### **Recreational Facilities WQ**

**Sampling started in June 2003 and ended in September 2003, the highest recreational-use period.**

**Four WQ stations each at Bidwell Canyon and Lime Saddle Marinas:**  
**(bacteria, minerals, nutrients, petroleum byproducts)**

- 1. Marina**
- 2. Boat ramp**
- 3. Houseboat Moorages (2)**

**Five Lake Oroville WQ stations:** **(petroleum byproducts)**

- 1. Lake Oroville at Dam**
- 2. Lake Oroville – Main**
- 3. Lake Oroville Middle Fork**
- 4. Lake Oroville North Fork**
- 5. Lake Oroville South Fork**

# ***Oroville Facilities Relicensing Project***

## ***California Department of Water Resources***



### **Recreational Facilities WQ**

**Eight WQ stations at specific recreational facilities: (bacteria, minerals, nutrients, petroleum byproducts)**

- 1. Bloomer Primitive Boat-In Campground**
- 2. Bloomer Island Floating Restroom**
- 3. Craig Saddle Boat-In Campground**
- 4. Goat Ranch Boat-In Campground**
- 5. Kelly Ridge Floating Restroom**
- 6. Potter Ravine Floating Campground**
- 7. Stringtown Floating Campground**
- 8. Union Creek Floating Campground**

# *Oroville Facilities Relicensing Project*

## *California Department of Water Resources*



### **Recreational Facilities WQ**

#### *Results*

**Arsenic** (total and dissolved) was above water-quality criteria at all of the recreational facility WQ stations. The levels found at the recreational WQ stations was at the same levels as the Lake Oroville stations in SPW-1. **MTBE** was found at the recreational WQ stations, usually above water-quality criteria. **MTBE** was not found, or was found rarely at very low levels, at the lake and specific facility stations.

#### *Study Conclusion*

The current recreational facilities do seem to have a minimal effect to water quality. Most parameters were no different from the background levels found in Lake Oroville open-water stations in SPW-1, with the exception of **MTBE**. **MTBE**, which was rarely found at the open-water stations, exceeded water quality criteria at all of the boating related facilities.



# ***Oroville Facilities Relicensing Project***

## ***California Department of Water Resources Recreational Facilities WQ – Trails***

**The seven interconnected multi-use trails in and around the Oroville Facilities were checked for surface type and erosion.**

<i><b>Trail</b></i>	<i><b>Length (miles)</b></i>	<i><b>Primary Uses</b></i>
Bidwell Bar Bridge	0.66	Hiking
Brad Freeman	44.2	Hiking/Biking/Horse
Dan Beebe	14.5	Hiking/Biking/Horse
Chaparral Loop	0.25	Hiking/Biking/Horse
Kelly Ridge	4.8	Hiking/Biking/Horse
Loafer Creek	13.8	
<i>Campfire Center</i>	<i>0.5</i>	Hiking
<i>Day-Use Area</i>	<i>0.6</i>	Hiking
<i>Loafer Creek</i>	<i>3.2</i>	Hiking/Biking/Horse
<i>Loafer Creek Loop</i>	<i>3.9</i>	Hiking/Biking/Horse
<i>Roy Rogers</i>	<i>5.6</i>	Hiking/Biking/Horse
Potter Ravine	10.0	
<i>Dead Cow Ravine</i>	<i>1.2</i>	Hiking/Biking
<i>Potter Point</i>	<i>0.4</i>	Hiking/Biking
<i>Potter Ravine</i>	<i>8.4</i>	Hiking/Biking
Visitors Center	<u>0.3</u>	Hiking
<i><b>Total</b></i>	<b>88.5</b>	



# ***Oroville Facilities Relicensing Project***

## ***California Department of Water Resources***

### **Recreational Facilities WQ - Trails**

<i><b>Surface</b></i>	<i><b>Width (feet) Range (Mean)</b></i>	<i><b>Length (miles)</b></i>	<i><b>Percent</b></i>	<i><b>Resistance to Erosion</b></i>
<i><b>Wood</b></i>	<i><b>18 (18)</b></i>	<i><b>0.05</b></i>	<i><b>0.05</b></i>	<i><b>High</b></i>
<i><b>Dirt</b></i>	<i><b>1-25 (6)</b></i>	<i><b>9.8</b></i>	<i><b>56.2</b></i>	<i><b>Poor</b></i>
<i><b>Gravel</b></i>	<i><b>5-30 (16)</b></i>	<i><b>21.9</b></i>	<i><b>24.7</b></i>	<i><b>Moderate</b></i>
<i><b>Paved</b></i>	<i><b>3-30 (11)</b></i>	<i><b>16.9</b></i>	<i><b>19.0</b></i>	<i><b>High</b></i>
<i><b>Total</b></i>	<i><b>1-30 (8)</b></i>	<i><b>88.5</b></i>	<i><b>100</b></i>	





Lake Oroville

Thermalito  
Forebay

City of  
Oroville

Thermalito  
Afterbay

Feather River

Project Boundary



Trails



Dirt



Gravel



Paved



Wood





# ***Oroville Facilities Relicensing Project***

## ***California Department of Water Resources***

### **Recreational Facilities WQ – Trails**

#### ***Results***

**Erosion along the trails is widespread, but each erosion event is highly localized.**

**Some fairly severe damage was observed along some of the steeper trails on both sides of the Diversion Pool at shortcuts across switchbacks.**

**Some segments of the trails within the Loafer Creek RA are at too high a gradient, leading to rutting from normal use and rain runoff.**

**Bridges and culverts crossing intermittent streams or swales are rare or absent on many trails, leading to erosion and transport of sediment downslope.**

**Trail maintenance along the Kelly Ridge and Dan Beebe Trails has led to erosion when vegetation was cut back and removed without adequate erosion prevention or sedimentation abatement measures in place.**

#### ***Study Conclusion***

**The erosion events are too small and too localized to affect water quality in project waters.**

# ***Oroville Facilities Relicensing Project***

## ***California Department of Water Resources***



### ***Swim Areas Bacteria Sampling***

**Swim areas associated with project waters were sampled monthly for total coliform, fecal coliform, fecal streptococcus, and enterococcus bacteria from June 2003 to November 2003. Additionally, sampling was performed twice a week for two weeks prior to and two weeks after the Fourth of July holiday.**

#### ***Developed Swim Areas***

**Bedrock Park (Feather River)**

**North Thermalito Forebay RA**

**South Thermalito Forebay RA**

**Loafer Creek RA Day-Use Area (Lake Oroville)**

**Monument Hill RA (South Thermalito Afterbay)**

#### ***Undeveloped Swim Areas***

**Foreman Creek Boat Ramp**

**Stringtown Boat Ramp**



# *Oroville Facilities Relicensing Project*

## *California Department of Water Resources*



## **Swim Areas Bacteria Sampling**

### *Results*

Bacteria levels were routinely high at most of the developed swim areas and only occasionally at the undeveloped swim areas. For example, North Thermalito Forebay RA beach, the most popular swim area, exceeded water-quality criteria for **enterococcus bacteria** in 92% of samples (23/25) and for **fecal coliform bacteria** in 80% of samples (20/25), while Stringtown boat ramp exceeded criteria for **enterococcus bacteria** in 16% of samples (4/25) and **fecal coliform bacteria** in 4% of samples (1/25).

### *Study Conclusion*

The enterococcus bacteria levels are indicative of poor water quality at some of the developed swim areas. The developed swim areas could be adversely affecting water quality in project waters.

# ***Oroville Facilities Relicensing Project***

## ***California Department of Water Resources***



### **Fishing Tournament/Weekend Sampling**

**Sampling was performed in August and September 2003 prior to start of fishing tournament (~0530) and immediately after last boat was retrieved (~1400) on Saturday and Sunday. Water samples were analyzed for petroleum byproducts only.**

#### **Two sampling stations at Spillway Boat Ramp:**

- 1. Boat ramp**
- 2. Control station (located outside of Spillway boat ramp cove)**

#### **Three WQ stations each at Bidwell Canyon :**

- 1. Marina**
- 2. Boat ramp**
- 3. Control station (located outside of Bidwell Canyon)**

# *Oroville Facilities Relicensing Project*

## *California Department of Water Resources*



## **Fishing Tournament/Weekend Sampling**

### *Results*

**MTBE** was found at the sampling stations, usually above water-quality criteria. **MTBE** was not found, or was found at very low levels, at the control stations. Other petroleum byproducts, such as toluene and xylene, were present, but at levels below criteria.

### *Study Conclusion*

Fishing tournaments do seem to have a minimal effect to water quality. **MTBE**, which is rarely found at the open-water stations, exceeded water quality criteria at all of the sampling stations.

# ***Oroville Facilities Relicensing Project***

## ***California Department of Water Resources***



### **Bidwell Marina Special Sampling**

**Sampling commenced in September 2003 and is still on-going. Sampling began in response to concerns about the release of tributyltin (TBT, a biocide) and polybrominated diphenyl ethers (PBDE, a fire-retardant) from marinas, docks, and boat yards. Metals and petroleum byproducts were also sampled.**

**Six sampling stations at Bidwell Canyon Marina:**

- 1. Marina**
- 2. Houseboat moorages (2)**
- 3. Boat Docks (3)**

# *Oroville Facilities Relicensing Project*

## *California Department of Water Resources*



### **Bidwell Marina Special Sampling**

#### *Results*

**TBT** and **PBDE** were not found at detectable levels. **MTBE** was found at the sampling stations, usually above water-quality criteria. Other petroleum byproducts, such as **toluene** and **xylene**, were present, but at levels below criteria.

#### *Study Conclusion*

While the marinas do seem to have a minimal effect to water quality, especially with petroleum byproducts, **TBT** and **PBDE** are not a water quality concern at Bidwell Canyon.



# *Oroville Facilities Relicensing Project*

## *California Department of Water Resources*



### **Lime Saddle Boat Yard Sand Analyses**

Samples of the sand used for sand-blasting boat hulls were taken from the Lime Saddle Boat Yard in October 2003 for analysis. The results were compared to sediment and soil criteria from the CDTSC and the CRWQCB (CDWR, 1995).

#### *Results*

**Volatile organic compounds** (aromatic hydrocarbons) were not found at detectable levels in either sample. **Semi-volatile organic compounds** (polynuclear aromatic hydrocarbons) were present in both samples, but below established criteria. Metals were present, but neither of the samples contained any amounts of metals exceeding any of the soil criteria.

#### *Study Conclusion*

Analyses of sand samples from the Lime Saddle Boat Yard indicate that cleaning sand could potentially contribute some amount of contamination to Project waters. While there were no criteria exceeded, the samples did contain a number of metals and petroleum byproducts in detectable amounts.

# ***Oroville Facilities Relicensing Project***

## ***California Department of Water Resources***



### **Storm Event Sampling 2003**

**Storm event sampling at recreational facilities was performed in November and December of 2003 for bacteria, metals, minerals, nutrients, pesticides, and toxicity.**

#### ***Sampling stations:***

**Bidwell Canyon Boat Yard (2)**

**Bidwell Canyon parking lot**

**Lime Saddle Boat Yard (2)**

**Lime Saddle parking lot (2)**

**North Thermalito Forebay Sailboat Club Marina**



# *Oroville Facilities Relicensing Project*

## *California Department of Water Resources*

### **Storm Event Sampling 2003**

#### *Results*

Minerals, nutrients, and most metals did not exceed water quality criteria. **Arsenic, manganese, and zinc** did exceed water quality criteria. **Total arsenic** levels exceeded water criteria in every sample, well above background levels. **Manganese** exceeded criteria twice. Both **dissolved** and **total zinc** exceeded water quality criteria for the protection of aquatic life in the majority of the water samples. Petroleum byproducts and pesticides were not detected in the samples.

#### *Study Conclusion*

Stormwater runoff from the recreational facilities could affect water quality in project waters through the introduction of higher than normal metals levels.

# ***Oroville Facilities Relicensing Project***

## ***California Department of Water Resources***



### ***Study Plan SPW-3***

#### ***Recreational Facilities and Operations Effects on Water Quality***

### ***Conclusions***

**Some water quality effects have been found at some of the recreational facilities, such as:**

- petroleum byproducts from boating-related facilities;**
- bacteria from developed swim areas; and,**
- total and dissolved metals from storm runoff.**